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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

VU, TUAN A

ART UNIT	PAPER NUMBER
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2193

DATE MAILED: 06/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/976,313

Applicant(s)

HARRISON ET AL.

Examiner

Tuan A. Vu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 April 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-6,8-12,14-18 and 21-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-6,8-12,14-18 and 21-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to the Applicant's response filed 4/11/2005.

Claims 2-6, 8-12, 14-18 have been amended, and claims 1, 7, 13, 19-20 canceled.

Claims 2-6, 8-12, 14-18 and 21-25 are pending in the Office Action.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. Claims 2-6 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

The Federal Circuit has recently applied the practical application test in determining whether the claimed subject matter is statutory under 35 U.S.C. § 101. The practical application test requires that a "useful, concrete, and tangible result" be accomplished. An "abstract idea" when practically applied is eligible for a patent. As a consequence, an invention, which is eligible for patenting under 35 U.S.C. § 101, is in the "useful arts" when it is a machine, manufacture, process or composition of matter, which produces a concrete, tangible, and useful result. The test for practical application is thus to determine whether the claimed invention produces a "useful, concrete and tangible result".

As per claim 2, here is recited a method comprising assigning a definition-node and a use-node for statements in intermediate language program; assigning an alias-node representing a equivalence class access; introducing an edge in the flow graph connecting definition-node and its alias node representing a equivalent class of definition-node; and introducing en edge in the flow graph connecting each use node to its alias representing a equivalent class of use-node. The above steps of assigning and defining do not amount to generating a concrete, tangible, and useful result in any art of programming. Even though the claim elaborates steps working on elements of a graph based on an intermediate code analysis, there is no reciting of any action that

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conveys firmly the notion that the steps are necessarily done with hardware embodiment or executed under some hardware support, i.e. the steps can be done via a pen/paper process or visual analysis of code on paper. Thus the claim is not leading to useful application as required by the practical application test from above. Hence, the claim merely amounts to non-practical idea, and is rejected for leading to a non-statutory subject matter.

As per claims 3-6, these claims are computer-medium claim, apparatus claim for performing the same steps recited in claim 2; hence are marred with the same type of deficiency as mentioned therein -- e.g. lacking a computer readable media having instructions code when executed perform the steps of -- and are thereby also rejected for leading to a non-statutory subject matter.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 2-6, 8-12, 14-18 and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cramer et al., USPN: 5,107,418 (hereinafter Cramer) in view of Archambault, USPN: 6,173,444 (hereinafter Archambault).

As per claim 2, Cramer discloses a method comprising
defining a definition-node and a use-node for a variable definition in intermediate
language (e.g. col. 3 lines 47-51; col. 4, lines 12-46; *program IR* - Fig. 1; col. 4, lines 14-16 –

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Note: create DUDe nodes reads on definition-node and use-node for each variable in a chain of the graph);

assigning an alias node for one or more aliases representing an equivalence class of memory accesses (e.g. step 613, step 615 – Fig. 6 – Note: identification of one memory conflict operations as alias grouping aliased node together is equivalent to identifying one equivalence class – see *multiple_alias* Appendix pg. 17-18); and introducing an edge into a dependence flow graph connecting a alias corresponding to a equivalence class associating a definition node (step 615, 617, 618: YES – Fig. 6); introducing an edge in a dependence flow graph connecting a alias corresponding to a equivalence class associating a use node (steps 616: YES, step 615 - Fig. 6).

But Cramer does not explicitly disclose assigning definition-node or use-node for one or more definition statements. But a node in a chain of statements in an intermediate language analysis in the art of analyzing data dependency and alias resolution entails defining statements the analysis of which leads to reference pointer issues that are to be addressed (see Fig. 2 and related text); hence the creation of def-use nodes for more definition statements is disclosed. Otherwise, such limitation would have been obvious because Cramer not only addresses pointer dereference in some equivalence class resolution but also mentions that the node to be created from the equivalence class resolution are involving various type of basic type (col. 4, lines 30-37) and also works with a set of plural definition sets to address (col. 6, line 67 to col. 7, line 6) and intends to address variable or dereferencing effects of called procedures (col. 2, line 66 to col. 3, line 2). Definition statements can be seen from block analysis (see Cramer Fig. 2) and this is further disclosed in the intraprocedural or interprocedural by Archambault (e.g. col. 5, line 4-56) wherein analysis of statements defined for function calls therein involves r-val and l-val,

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i.e. one or more definition statements. In case the deferencing of variables in the deferencing side effects (e.g. of procedure calls) by Cramer is not considered a plurality of definition statements, it would have been obvious for one of ordinary skill in the art at the time the invention was made to expand the creation of def-node or use-node by Cramer so that it also applies to the inter/intra procedure creation of nodes in relation (one or more definition statements) to alias setting when establishing dependency in control flow graph as taught by Archambault because set of objects that the compiler needs to keep track of amounts to more than single variables in order resolve pointer dependency when resolving all aliases assumptions in increasingly complex program; and by approaching pointer issue by Archambault via set as of related objects, the alias resolution in so doing can also reduce the size of program (see Archambault, col. 2-3).

As per claim 3, Cramer discloses performing a memory alias analysis of said intermediate language program to partition the memory accesses of said intermediate language program into equivalence classes such that any two memory accesses that reference the same storage location belong to the same equivalence class (e.g. *equivalenced or aggregate* - col. 5, lines 28-46 col. 6, lines 34-61; col. 7, line 48 to col. 8, line 9; step 114 –Fig 2).

As per claim 4, Pande discloses analysis using said dependence flow graph (e.g. Fig. 1).

As per claim 5, Cramer discloses adding said alias-node to a set of nodes (Fig. 6) but does not disclose for each alias-node in the dependence flow graph assigning an initial value to the alias corresponding to said alias-node prior to the adding; but Archambault, discloses assigning a initial set of alias node with initial information saved therein (col. 5, lines 6-15 – step a); adding successors node to an alias-node (e.g. *pseudo* – col. 5, lines 18-23 – step c). Hence,

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this step of assigning an initial value to a alias would have been obvious for Cramer to use in order to keep track what actually has been used in the working set of alias nodes as approached by Archambault. In view of the teachings by Cramer (see step 613 –Fig 6) and Archambault to keep track with evolution of initial set of alias nodes so that data being resolved in the procedural call flow with actual updating of R-val upon resolution of alias set inside of procedures (see Archambault, Fig. 1-3), the implementation by Archambault with updating of initial values being provided as an enhancement to Cramer's method for marching up and down basic blocks (see Appendix pg. 27-28) would have been obvious for one skill in the art at the time the invention was made because in doing so all the intraprocedural alias-related reference would be solved and propagate this into the interprocedural techniques as taught by Archambault to achieve the code optimization of basic blocks and inter/intra procedural alias resolution techniques as intended by both Cramer and Archambault.

As per claim 6, Cramer does not disclose that said initial value comprises a set of abstract values to form a join-complete partial order. But official notice is taken that initializing each element in a set to be processed by an algorithm so that when the algorithm finished as complete the concept of joining the initial set with the recurring operations taking place during iterative steps of the algorithm was a known concept at the time the invention was made, and this is partially evidenced by Cramer (e.g. *removed ... from GEN set* - col. 6, lines 20-28; *sets, Aho, Sethi & Ullman* - col. 7, lines 32-41; Appendix B, pg. 9-10, *list in, out, NULL list*). And the iteration so to join the initial elements as results are obtained for updating the initial set is disclosed or strongly suggested by Archambault when creating alias node and associated R-val are updated (see Fig. 1-3). Hence, by resolving the initial data being stored at the variables

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representing alias node, the concept of completing a partial order is disclosed, i.e. joining the initial value with the actual value and put forth the final result as the most significant of the two (see Archambault, Fig. 2-3). Hence, this limitation would have been obvious by virtue of the rationale using the initial set as set forth in claim 5 above, combining Archambault's initial set updating to Cramer's basic block traversal and alias resolution.

As per claims 8-10, these claims correspond to claims 2-4, respectively; and are rejected with the corresponding rejection as set forth therein.

As per claims 11-12, these claims correspond to claims 5-6, respectively; and are rejected with the corresponding rejection as set forth therein.

As per claims 14-16, these claims correspond to claims 2-4, respectively; and are rejected with the corresponding rejection as set forth therein.

As per claims 17-18, these claims correspond to claims 5-6, respectively; and are rejected with the corresponding rejection as set forth therein.

As per claim 21, this claim is an apparatus claim incorporating means for performing the same steps as recited in claim 2 or 14; hence is rejected with the corresponding rejection as set forth therein.

As per claim 22, see claim 4.

As per claim 23, Cramer discloses adding said alias-node to a set of nodes (Fig. 6) but does not explicitly disclose having a initial set of nodes and remove a node from the set as each node is processed for adding in the dependence flow; but the concept to start a algorithmic process as mentioned by Cramer (e.g. *removed ... from GEN set* - col. 6, lines 20-28; sets, Aho, Sethi & Ullman - col. 7, lines 32-41; Appendix B, pg. 9-10, *list in, out, NULL list*) in order to go

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through every elements to be processed using a set and emptying it until all the elements therein have been processed was a known concept by algorithm execution engine or compilers. And this start set limitation for an algorithmic process until completion is disclosed; or else would have been obvious because based on Cramer's teachings from above one skill in the art would be motivated to use start set of elements containing some unresolved aliased node so that it would make the execution of the algorithm more visibly manageable thereby efficiently support the global variables dependency resolution in Cramer's def-use method until the loop is completed checked (see Fig. 4-6).

Further, Cramer does not disclose a statement of the form PUT (A, E), even though Cramer discloses resolving via creating definition/use grouping in terms of Lval and set a flag (Appendix: *bv-index*, *Lval* - pg. 13-14) from basic block defining of set in and out of the basic blocks; which is further enhanced by Archambault. That is, Archambault (e.g. col. 5, line 4-56) discloses analysis of statements defined for function calls therein involves r-val and l-val, i.e. one or more definition statements; hence disclose evaluating an expression to retrieve a r-val from a l-val, i.e. obtaining a evaluation of E to store it into A, or PUT into A, based on an initial set from which to update as Archambault progresses along in the reduction of the alias graph (Fig. 2). It would have been obvious for one of ordinary skill in the art at the time the invention was made to enhance the r-val update as taught by Archambault to the alias tree generating by Cramer because by resolving the initial data being stored at the variables representing alias node in the grouping as mentioned by Cramer and reconciling the Lval(or A) with the correct Rval (or E) evaluation results (see Archambault, Fig. 2-3), the tree traversal and dependency resolution

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of Cramer in terms of global variables resolving (PUT based on E) or intra/interprocedural deference/reference issues can be improved as set forth in claim 6.

As per claims 24-25, these claims incorporate the rejection of claims 11 and 17 and further include the limitations that correspond to claim 23; and are rejected with the corresponding rejection as set forth therein.

Response to Arguments

6. Applicant's arguments filed 4/11/2005 have been fully considered but in view of the amendments to the claims, new grounds of rejection are necessitated. Applicant's arguments with respect to claims 1-21 have been considered but are now moot in view of the new ground(s) of rejection.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan A Vu whose telephone number is (272) 272-3735. The examiner can normally be reached on 8AM-4:30PM/Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on (571)272-3719.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273-3735 (for non-official correspondence – please consult Examiner before using) or 703-872-9306 (for official correspondence) or redirected to customer service at 571-272-3609.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

VAT
June 14, 2005


ANIL KHATRI
PRIMARY EXAMINER